Commercial Ship Transits Outside of Northern Channel Islands - Protecting Blue Whales and Increasing Ship Safety

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Blue whale ship strike risk greatest in S California especially SB Channel

Aquatic Mammals 2010, *36*(1), 59-66, DOI 10.1578/AM.36.1.2010.59

Association Between Blue Whale (*Balaenoptera musculus*) Mortality and Ship Strikes Along the California Coast

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8 Sept 2007	LACMNH-DSJ-2231	Los Angeles, Port of Long Beach, West Basin	3	M	22.0	Assumed ship strike
11 Sept 2007	SBMNH-2007-19	Santa Barbara Channel	4	F	24.0	Ship strike
12 Sept 2007		25 miles NE San Clemente Island	3	M		
19 Sept 2007		Playa Hermosa, Ensenada, Baja California, Mexico	3	U	22.0	
19 Sept 2007	SBMNH-2007-20	Santa Barbara Channel, South of Platform Grace	3	M	21.2	Ship strike
29 Nov 2007	SBMNH-2007-25	San Miguel Island, Simonton Cove	4	F	22.0	Ship strike

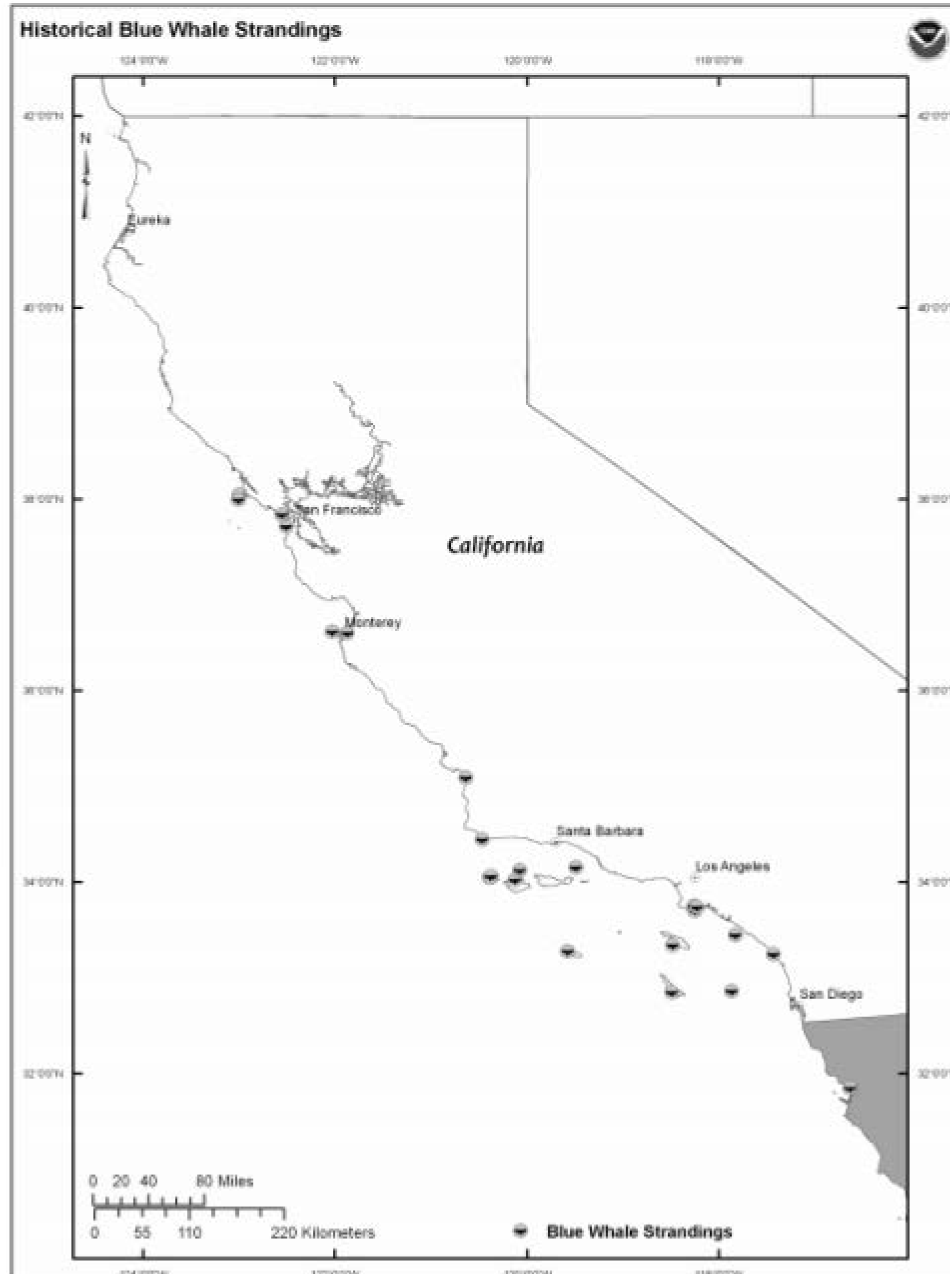
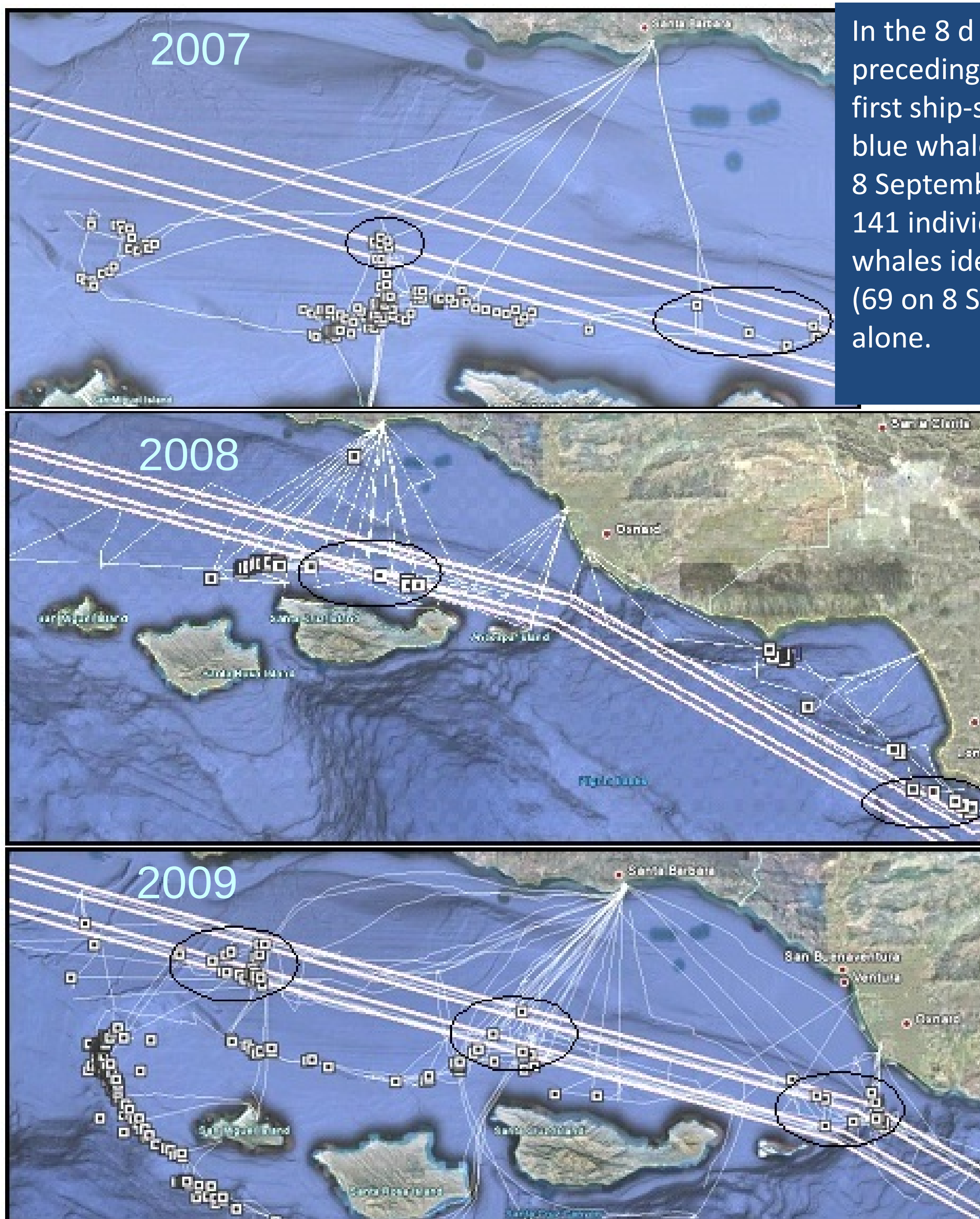


Figure 1. Initial locations of reported blue whale strandings with evidence of ship strike from 1988 through 2007

Areas of overlap between Cascadia Research blue whale sightings and shipping lanes



In the 8 d preceding the first ship-struck blue whale (1 to 8 September) 141 individual whales identified (69 on 8 Sept alone.

PARS avoids designating lanes due to Navy concerns

PORT ACCESS ROUTE STUDY

APPROACHES TO Los Angeles – Long Beach and in the Santa Barbara Channel

DOCKET #USCG-2009-0765

September 2011

- Page 13: Comments on this issue were received from the Naval Air Warfare Center Weapons Division Point Mugu, ….
- Page 13-14: The Point Mugu Sea Range is the nation’s largest air/sea test bed for missiles, free-fall weapons and electronic warfare systems. …. The Chief of Naval Operations (CNO) is mandated under Title 10 U.S. Code Section 5062 with the responsibility to ensure the readiness of the nation’s naval forces. Full battle group fleet exercises involving aircraft, surface ships, and submarines are conducted in the sea range without being affected by the flow of commercial vessels. Interested parties believe any attempt to create a new TSS within the sea range would disrupt the navy’s ability to effectively train forces, test and evaluate munitions, and provide for the security of the nation.
- Page 21-22: The Navy recommendation on this issue is to wait and see how ECA implementation affects vessel routing. Vessel traffic patterns could return to the Santa Barbara Channel TSS as commercial vessels will no longer have incentive to bypass it. A new TSS should not be recommended through the sea range before it is clear what the ECA’s impact will be.
- Page 30: A proposed TSS south of the Channel Islands may at times see increased use above historical norms and thus operations in the Point Mugu Sea Range may be impacted, but a well defined traffic route will increase predictability for vessel traffic passing through the range.

Change in vessel traffic with July 2009 CARB implementation (McKenna et al. 2012)

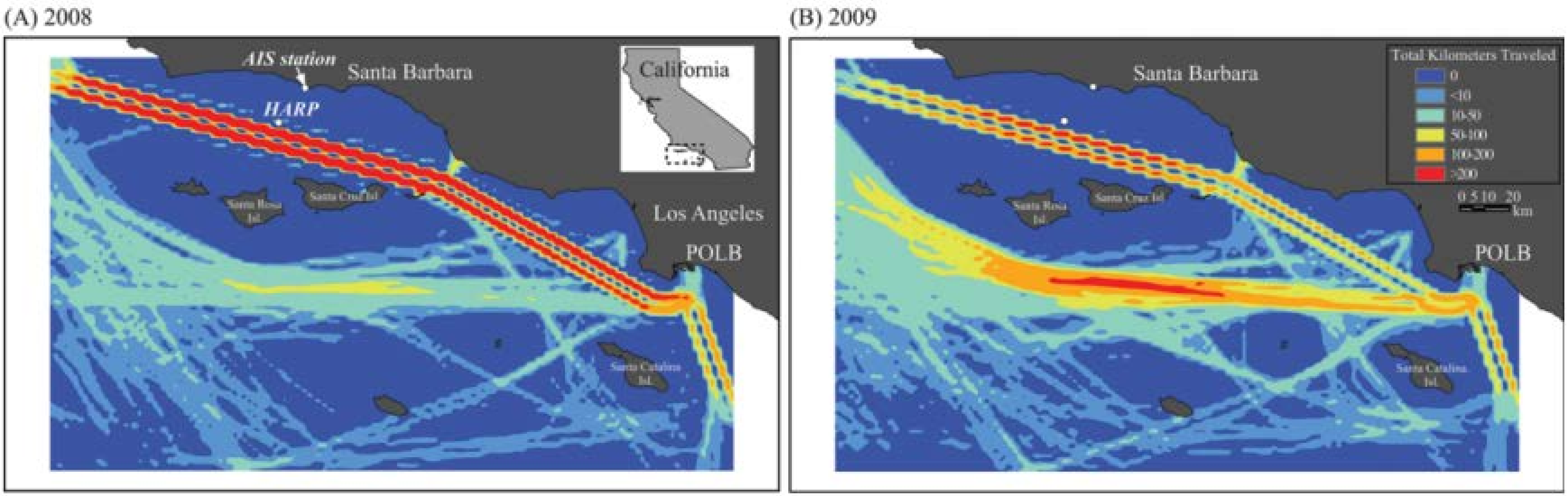


Fig. 1. Commercial ship traffic density off the coast of southern California: (A) 2008, (B) 2009. Maps show the locations of the HARP and AIS shore receiving station as white dots. In 2008 and 2009, AIS data from September 15th to November 1st for cargo and tanker vessels were converted to ship track lines and summed in each 2 km by 2 km grid cell. Colored surfaces represent total kilometers traveled per grid cell. Changing traffic pattern following the CARB ruling on ship fuel use, with increased traffic outside the SBC, is indicated by the enlarged orange-red areas south of the Channel Islands in 2009 (B). POLB label indicates the location of the Port of Long Beach and the Port of Los Angeles.

McKenna *et al.*: JASA Express Letters [http://dx.doi.org/10.1121/1.4740225] Published Online 7 August 2012

A quieting ocean: Unintended consequence of a fluctuating economy

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ENDANGERED SPECIES RESEARCH
Endang Species Res

Published online April 29

Simultaneous tracking of blue whales and large ships demonstrates limited behavioral responses for avoiding collision

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ABSTRACT: Collisions between ships and whales are reported throughout the world's oceans. For some endangered whale populations, ship strikes are a major threat to survival and recovery. Factors known to affect the incidence and severity of collisions include spatial co-occurrence of ships and whales, hydrodynamic forces around ships, and ship speed. Less understood and likely key to understanding differences in interactions between whales and ships is whale behavior in the presence of ships. In commercial shipping lanes off southern California, we simultaneously recorded blue whale behavior and commercial ship movement. A total of 20 ship passages with 9 individual whales were observed at distances ranging from 60 to 3600 m. We documented a dive response (i.e. shallow dive during surface period) of blue whales in the path of oncoming ships in 55% of the ship passages, but found no evidence for lateral avoidance. Descent rate, duration, and maximum depth of the observed response dives were similar to whale behavior immediately after suction-cup tag deployments. These behavioral data were combined with ship hydrodynamic forces to evaluate the maximum ship speed that would allow a whale time to avoid an oncoming ship. Our analysis suggests that the ability of blue whales to avoid ships is limited to relatively slow descents, with no horizontal movements away from a ship. We posit that this constrained response repertoire would limit their ability to adjust their response behavior to different ship speeds. This is likely a factor in making blue whales, and perhaps other large whales, more vulnerable to ship strikes.

Locations close encounters documented between ships and whales (McKenna et al. 2015)

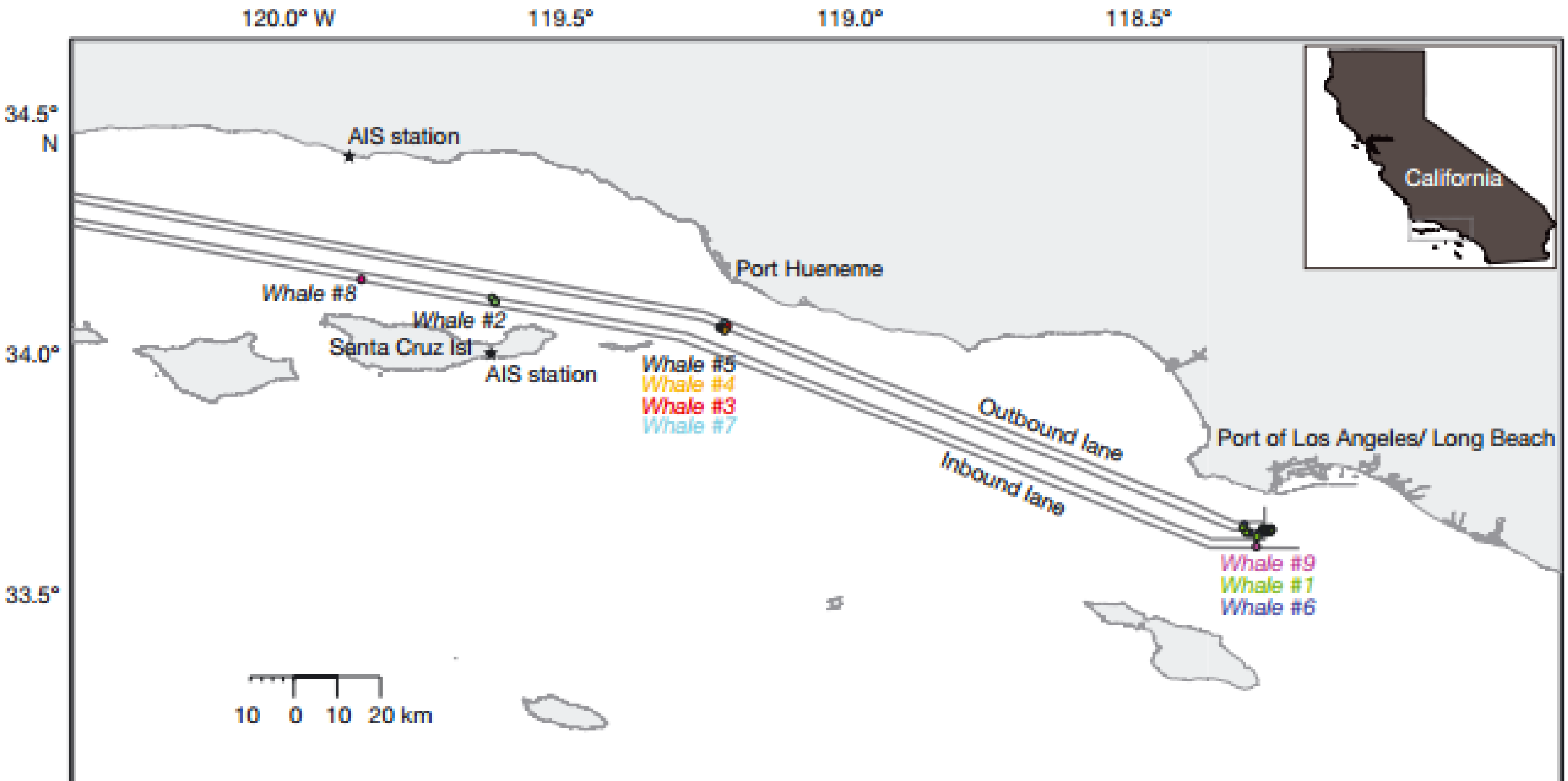


Fig. 1. Locations of documented ship passages to blue whales foraging off the coast of southern California. Whale numbering corresponds to Tables 1 & 2 and Figs. 2, 3, & 5. Black lines indicate the commercial shipping traffic lanes through the Santa Barbara Channel into the ports of Los Angeles/Long Beach. (★) Locations of the automatic identification system (AIS) receivers used to collect the ship-track information

Blue whale do not avoid ships (McKenna et al. 2015)

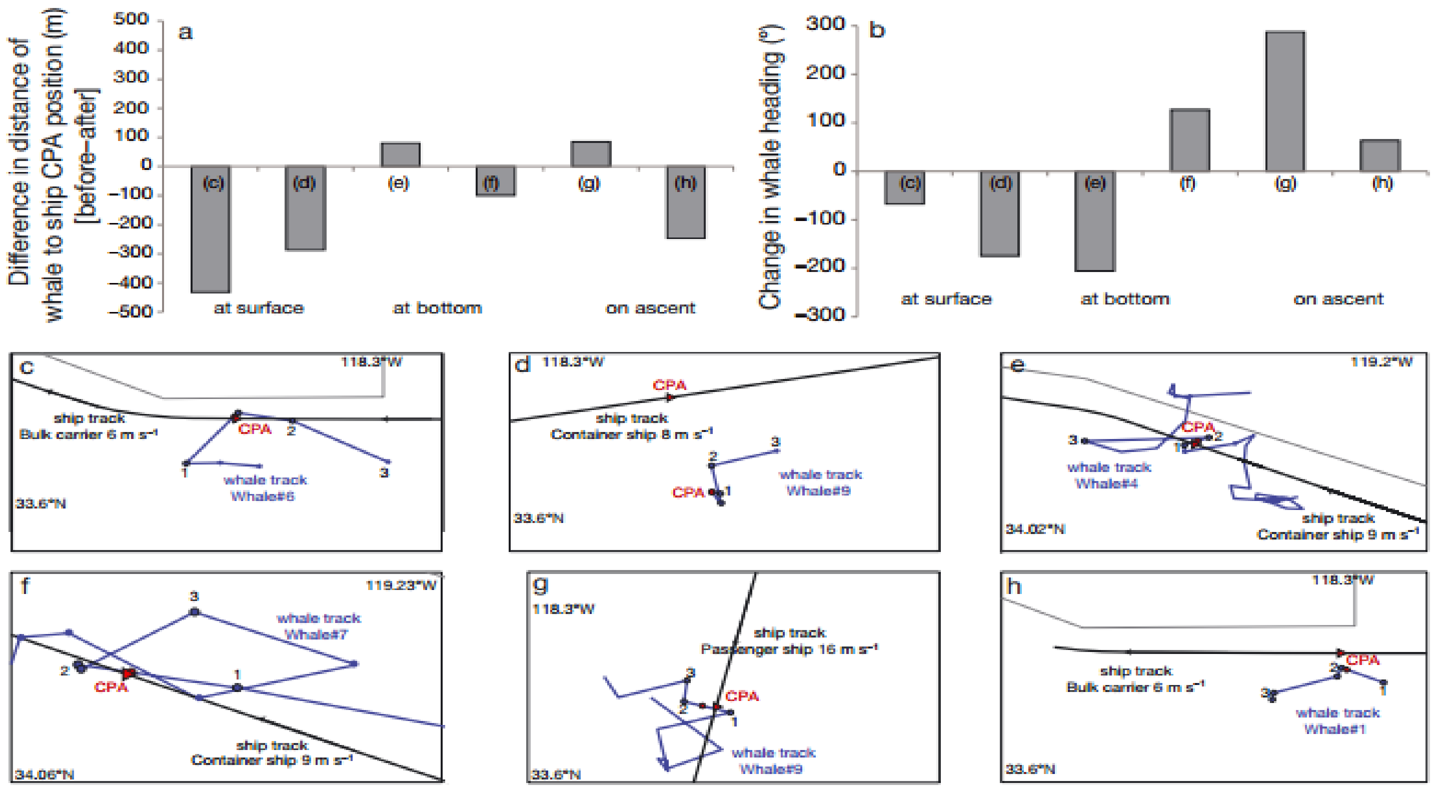
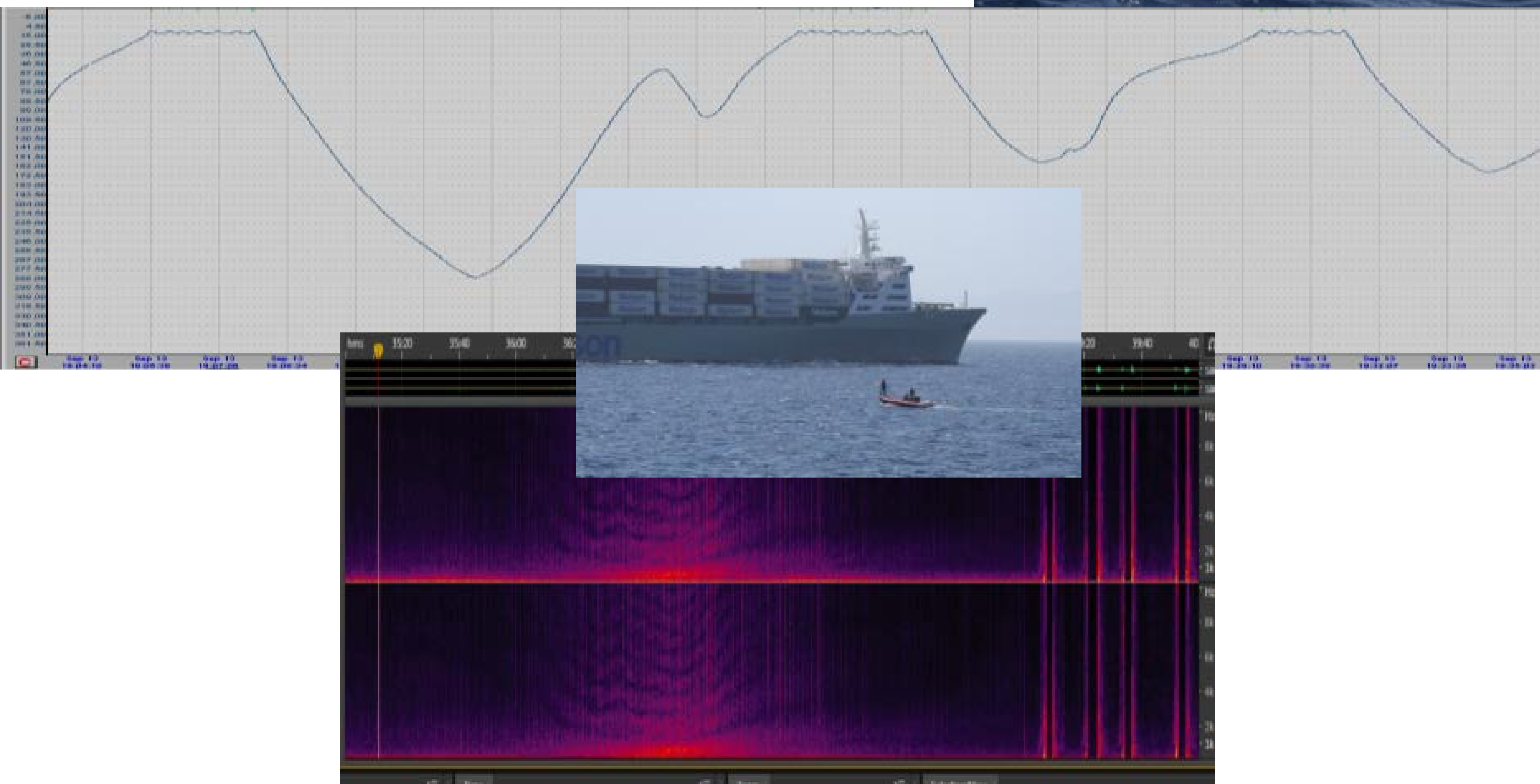


Fig. 3. Summary of horizontal surface movements of whales during ship passages that occurred at distances <300 m. (a) Difference in distance of the whale to the ship's closest point of approach (CPA) position; negative values indicate the whale moved closer to the ship's CPA position after CPA, and positive values indicate the whale moved further from the ship's CPA position. (b) Change in the heading of the whales before and after CPA. Headings were calculated as the direction (in degrees) from the CPA surface position to the position of the next surface period. The differences between headings were calculated. Values close to zero indicate little change in heading or, possibly, directed movement away from the path of a ship. Positive and negative values indicate the headings were not similar and, therefore, the whale was not traveling in a particular direction. The designations 'at surface', 'at bottom', and 'on ascent' indicate where the whales were during the CPA; the letters on the bars correspond to the lower panels (c–h) showing the surface movements of whales. (c–h) Details of whale movement at the time of CPA (indicated by red dot for whale positions and red triangle for ship positions). Data points indicate the order of surface periods — 1: before CPA; red: CPA; 2: after CPA; 3: 2 surface periods after CPA. In (c,e,h) the light gray lines are the borders of the shipping lanes; in (d,f,g) the shipping lanes are outside the resolution of the graphic. 1 knot = 0.514 m s^{-1}

Close ship approach to dual tagged blue whale 13 Sept 2014



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ENDANGERED SPECIES RESEARCH
Endang Species Res

Published online June 24

Seven years of blue and fin whale call abundance in the Southern California Bight

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ABSTRACT: Blue whales *Balaenoptera musculus* and fin whales *B. physalus* are common inhabitants of the Southern California Bight (SCB), but little is known about the spatial and temporal variability of their use of this area. To study their distribution in the SCB, high-frequency acoustic recording packages were intermittently deployed at 16 locations across the SCB from 2006 to 2012. Presence of blue whale B calls and fin whale 20 Hz calls was determined using 2 types of automatic detection methods, i.e. spectrogram correlation and acoustic energy detection, respectively. Blue whale B calls were generally detected between June and January, with a peak in September, with an overall total of over 3 million detections. Fin whale 20 Hz calls, measured via the fin whale call index, were present year-round, with the highest values between September and December, with a peak in November. Blue whale calls were more common at coastal sites and near the northern Channel Islands, while the fin whale call index was highest in the central and southern areas of the SCB, indicating a possible difference in habitat preferences of the 2 species in this area. Across years, a peak in blue whale call detections occurred in 2008, with minima in 2006 and 2007, but there was no long-term trend. There was an increase in the fin whale call index during this period. These trends are consistent with visual survey estimates for both species in Southern California, providing evidence that passive acoustics can be a powerful tool to monitor population trends for these endangered species.

Blue whale acoustic call detections by site show blue whale use of SB Channel (Sirovic at al. 2015)

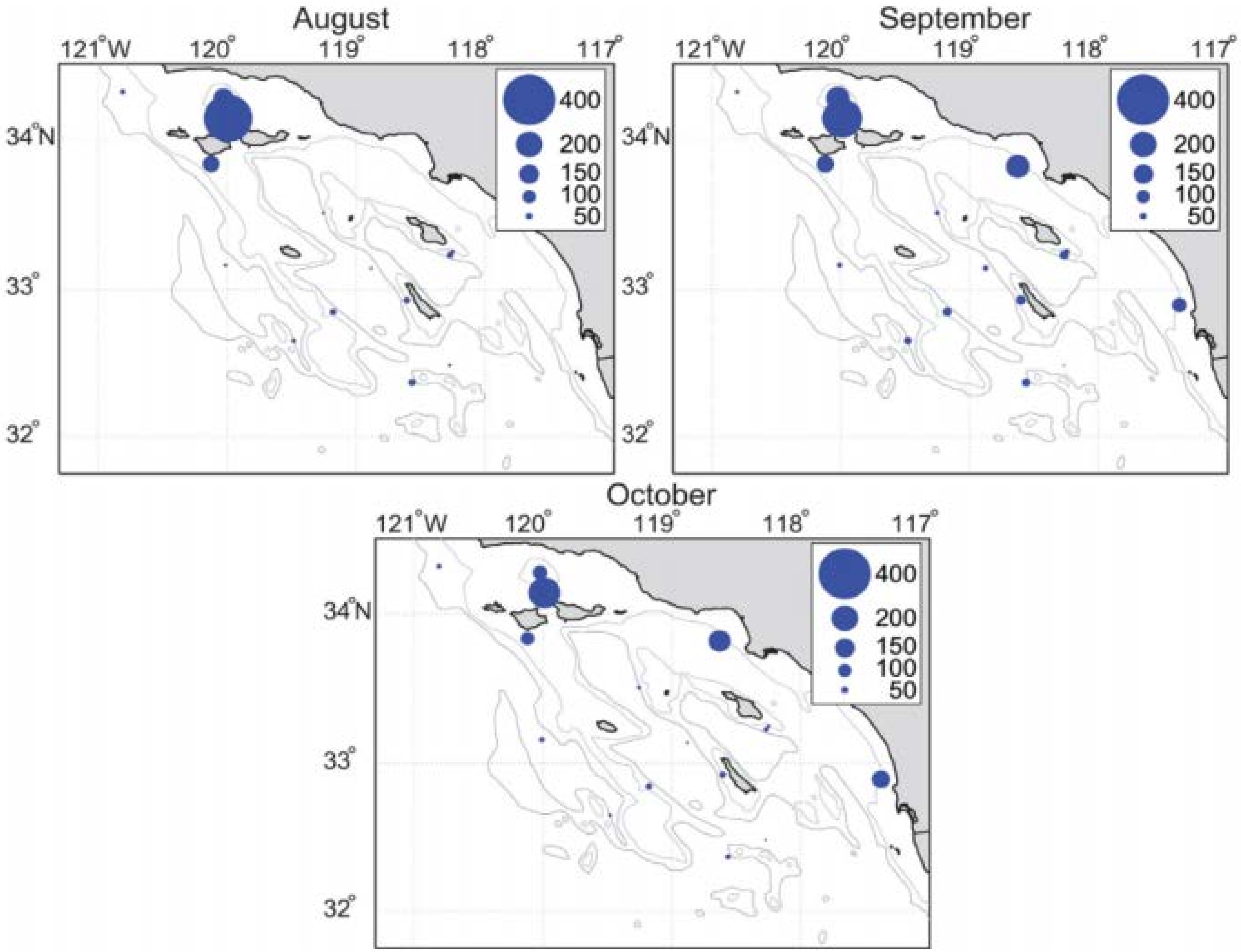

Fig. 6. Spatial distribution of blue whale (*Balaenoptera musculus*) B call detections across the Southern California Bight during peak calling months. Size of the circle represents average daily B call detection rate normalized by recording effort and detection area during a given month at that site across all years with data. Grey lines mark 500 and 1000 m bathymetry contours

Blue whale detections by season/site Sirovic et al. 2015

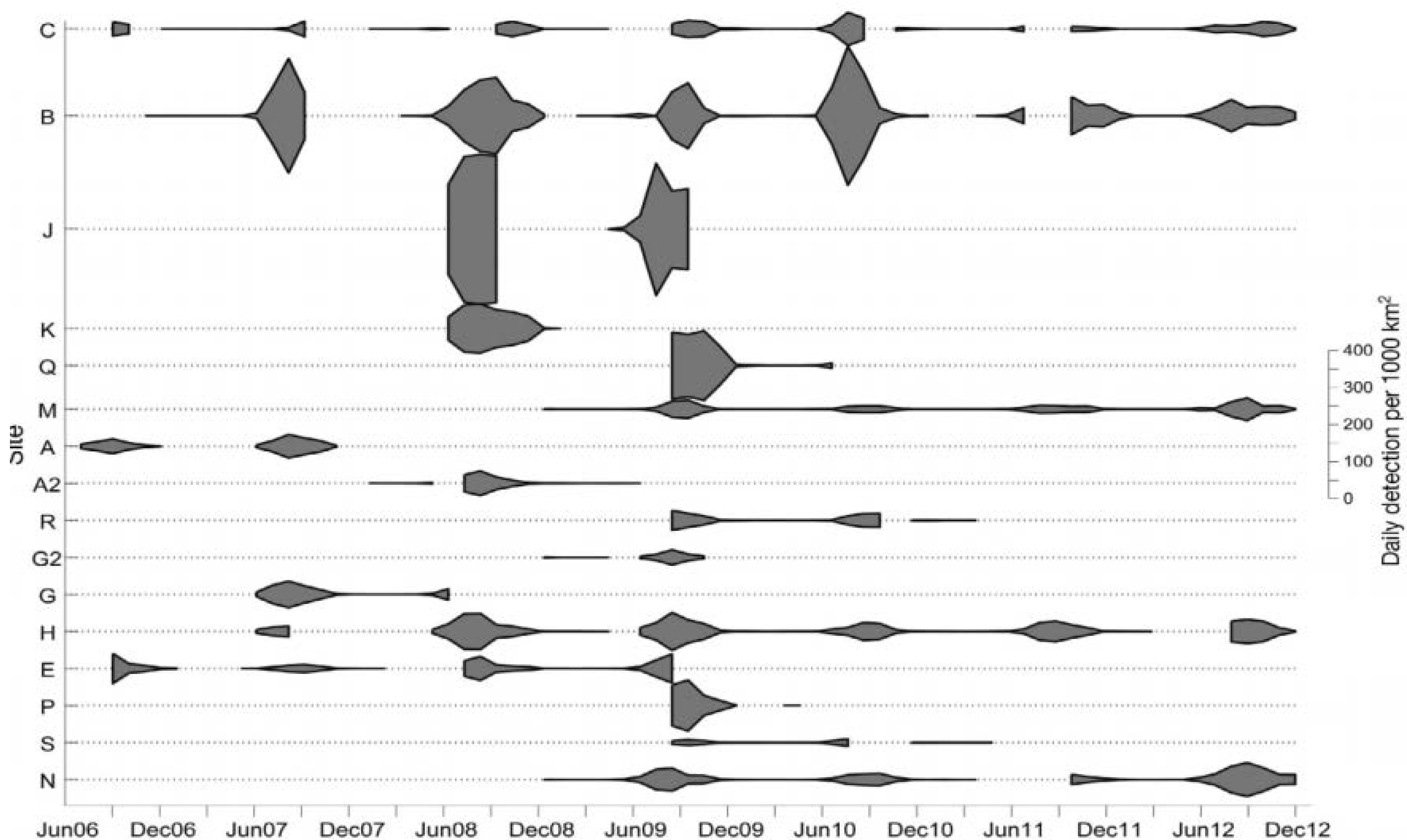

Fig. 5. Monthly averaged daily blue whale (*Balaenoptera musculus*) B call detection rates at each site in the Southern California Bight. Sites are arranged, to the maximum extent possible, from the northernmost sites at the top towards the southernmost sites at the bottom. Size of the patch represents the daily call detection rate normalized by recording effort and the detection area (see scale). Dotted lines are periods with no data at that site and solid lines denote periods with recording but no detected calls

Satellite tag data demonstrate overlap between blue whale core use areas and shipping lanes through SB Channel

OPEN ACCESS Freely available online

PLOS | ONE

Spatial and Temporal Occurrence of Blue Whales off the U.S. West Coast, with Implications for Management

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Abstract

Mortality and injuries caused by ship strikes in U.S. waters are a cause of concern for the endangered population of blue whales (*Balaenoptera musculus*) occupying the eastern North Pacific. We sought to determine which areas along the U.S. West Coast are most important to blue whales and whether those areas change inter-annually. Argos-monitored satellite tags were attached to 171 blue whales off California during summer/early fall from 1993 to 2008. We analyzed portions of the tracks that occurred within U.S. Exclusive Economic Zone waters and defined the 'home range' (HR) and 'core areas' (CAU) as the 90% and 50% fixed kernel density distributions, respectively, for each whale. We used the number of overlapping individual HRs and CAUs to identify areas of highest use. Individual HR and CAU sizes varied dramatically, but without significant inter-annual variation despite covering years with El Niño and La Niña conditions. Observed within-year differences in HR size may represent different foraging strategies for individuals. The main areas of HR and CAU overlap among whales were near highly productive, strong upwelling centers that were crossed by commercial shipping lanes. Tagged whales generally departed U.S. Exclusive Economic Zone waters from mid-October to mid-November, with high variability among individuals. One 504-d track allowed HR and CAU comparisons for the same individual across two years, showing similar seasonal timing, and strong site fidelity. Our analysis showed how satellite-tagged blue whales seasonally used waters off the U.S. West Coast, including high-risk areas. We suggest possible modifications to existing shipping lanes to reduce the likelihood of collisions with vessels.

Citation: Irvine LM, Mate BR, Winsor MH, Palacios DM, Bograd SJ, et al. (2014) Spatial and Temporal Occurrence of Blue Whales off the U.S. West Coast, with Implications for Management. PLoS ONE 9(7): e102959. doi:10.1371/journal.pone.0102959

Blue whale core areas of use from satellite tags showing key use of SB Channel (Irvine et al. 2014)

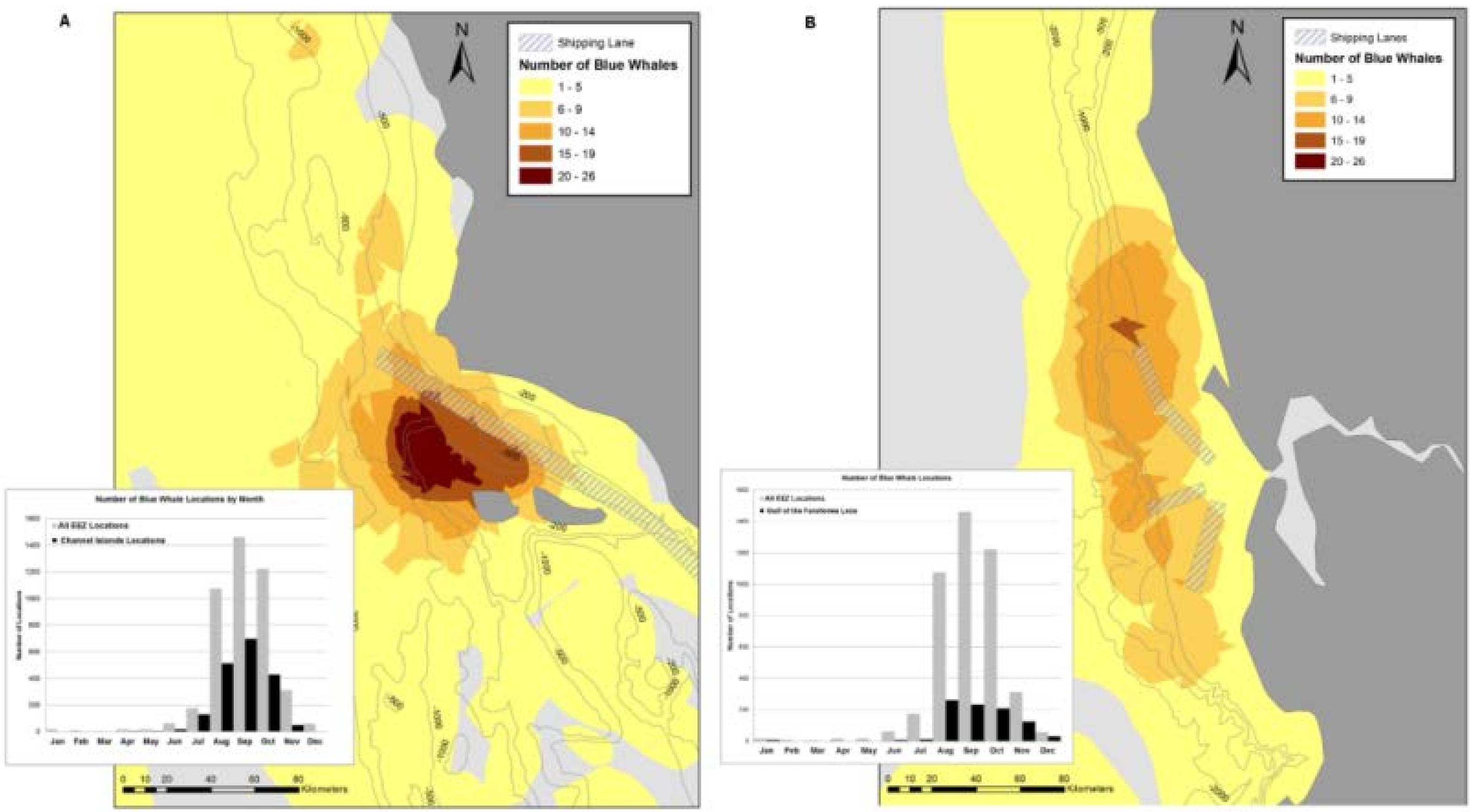

Figure 7. Number of overlapping blue whale Core Areas of Use near commercial shipping lanes. The Core Areas of Use were created from blue whale satellite tracks with >=30 daily locations inside the U.S. Exclusive Economic Zone. The regions shown are the Channel Islands (A) and the Gulf of the Farallones (B). Tags were deployed off California from 1998–2008. Hashed polygons represent the commercial shipping lanes transiting the area. Inset histograms show the overall number of blue whale locations recorded in the U.S. Exclusive Economic Zone (gray), and the number of locations recorded in the area shown (black).

doi:10.1371/journal.pone.0102959.g007

Aquatic Mammals 2015, *41*(1), 39-53, DOI 10.1578/AM.41.1.2015.39

Santa Barbara Channel is a key Biologically Important Area for blue whales

4. Biologically Important Areas for Selected Cetaceans Within U.S. Waters – West Coast Region

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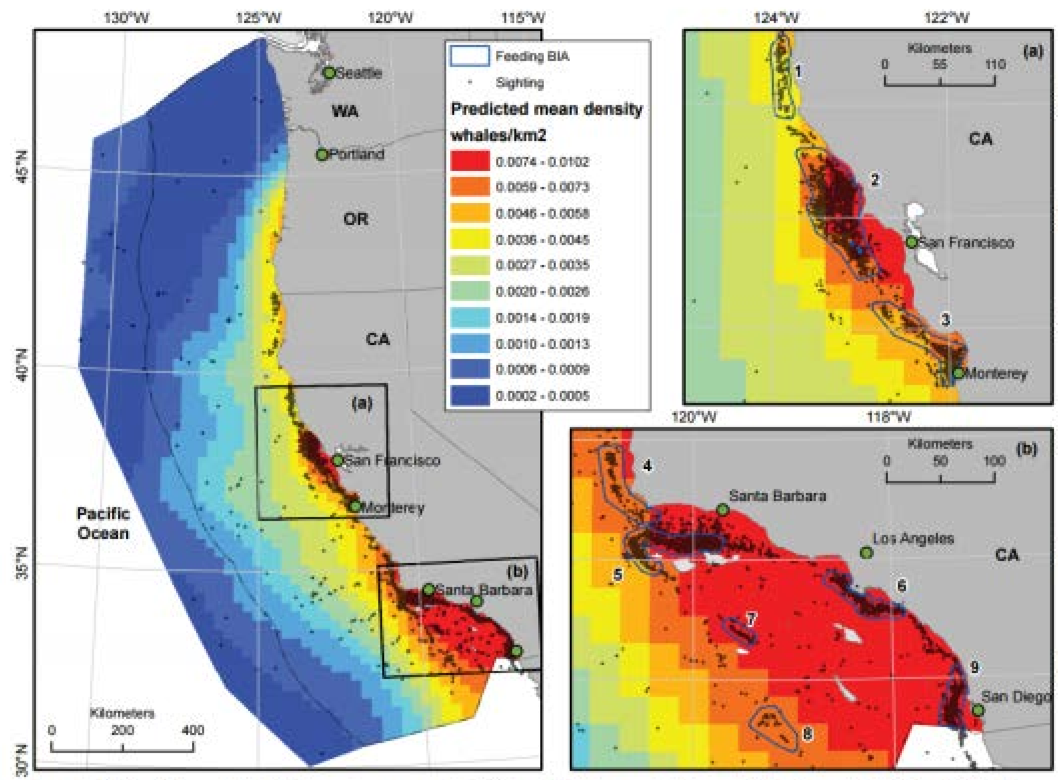

Figure 4.1. Nine blue whale (*Balaenoptera musculus*) Biologically Important Areas (BIAs), overlaid with all sightings and predicted mean densities of blue whales from habitat-based density (HD) models generated from Southwest Fisheries Science Center ship surveys (see Becker et al., 2012a). Panels a and b show more detail for the areas where the BIAs are located. The BIAs are (from north to south) (1) Point Arena to Fort Bragg, August-November; (2) Gulf of the Farallones, July-November; (3) Monterey Bay to Pescadero, July-October; (4) Point Conception/Arguello, June-October; (5) Santa Barbara Channel and San Miguel, June-October; (6) Santa Monica Bay to Long Beach, June-October; (7) San Nicholas Island, June-October; (8) Tanner-Cortez Bank, June-October; and (9) San Diego, June-October (see Table 4.1 for details).

SB Channel also key for humpback whales

Conservation Biology

Contributed Paper

Assessing the Risk of Ships Striking Large Whales in Marine Spatial Planning

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Abstract: *Marine spatial planning provides a comprehensive framework for managing multiple uses of the marine environment and has the potential to minimize environmental impacts and reduce conflicts among users. Spatially explicit assessments of the risks to key marine species from human activities are a requirement of marine spatial planning. We assessed the risk of ships striking humpback (Megaptera novaeangliae), blue (*Balaenoptera musculus*), and fin (*Balaenoptera physalus*) whales in alternative shipping routes derived from patterns of shipping traffic off Southern California (U.S.A.). Specifically, we developed whale-habitat models and assumed ship-strike risk for the alternative shipping routes was proportional to the number of whales predicted by the models to occur within each route. This definition of risk assumes all ships travel within a single route. We also calculated risk assuming ships travel via multiple routes. We estimated the potential for conflict between shipping and other uses (military training and fishing) due to overlap with the routes. We also estimated the overlap between shipping routes and protected areas. The route with the lowest risk for humpback whales had the highest risk for fin whales and vice versa. Risk to both species may be ameliorated by creating a new route south of the northern Channel Islands and spreading traffic between this new route and the existing route in the Santa Barbara Channel. Creating a longer route may reduce the overlap between shipping and other uses by concentrating shipping traffic. Blue whales are distributed more evenly across our study area than humpback and fin whales; thus, risk could not be ameliorated by concentrating shipping traffic in any of the routes we considered. Reducing ship-strike risk for blue whales may be necessary because our estimate of the potential number of strikes suggests that they are likely to exceed allowable levels of anthropogenic impacts established under U.S. laws.*

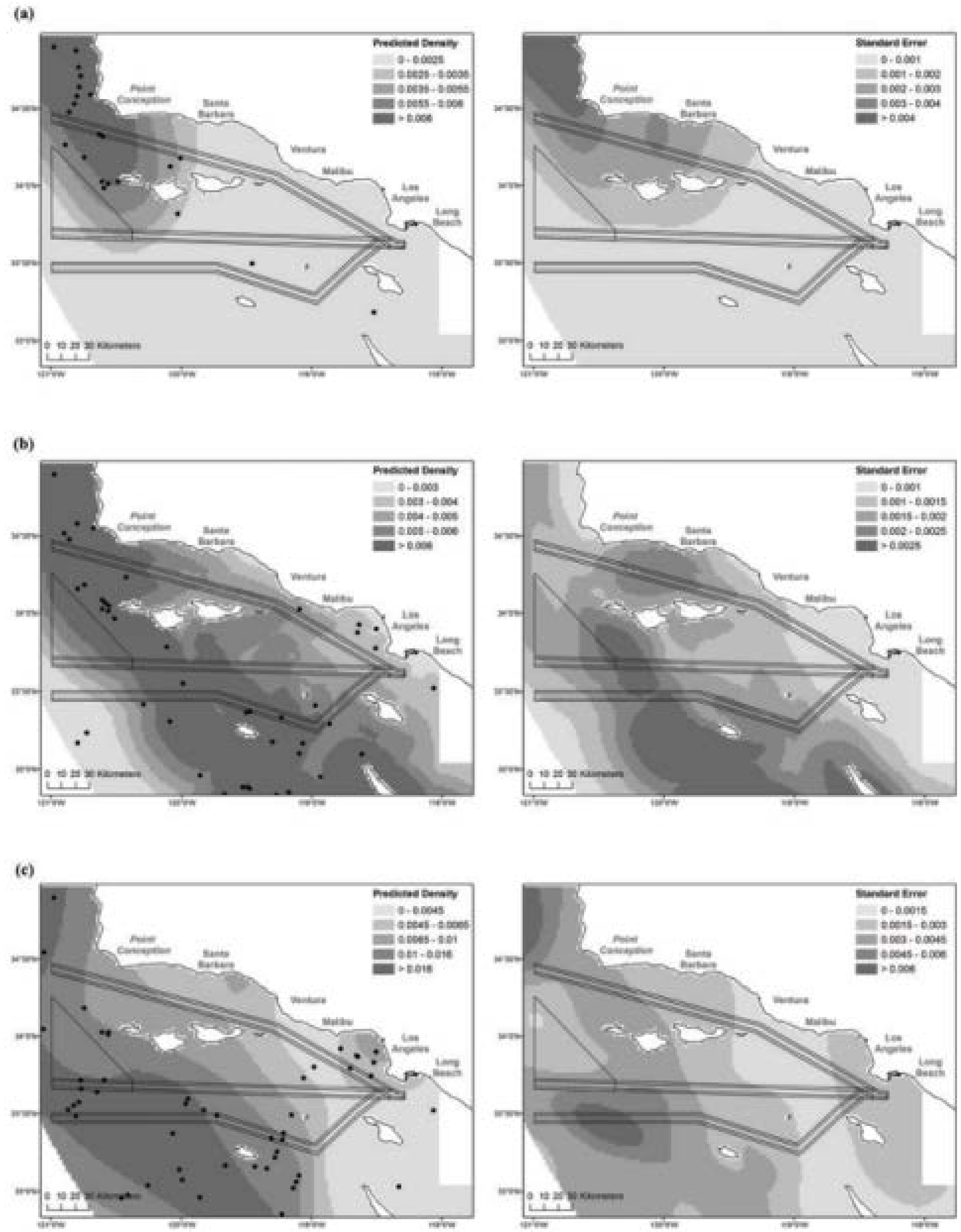
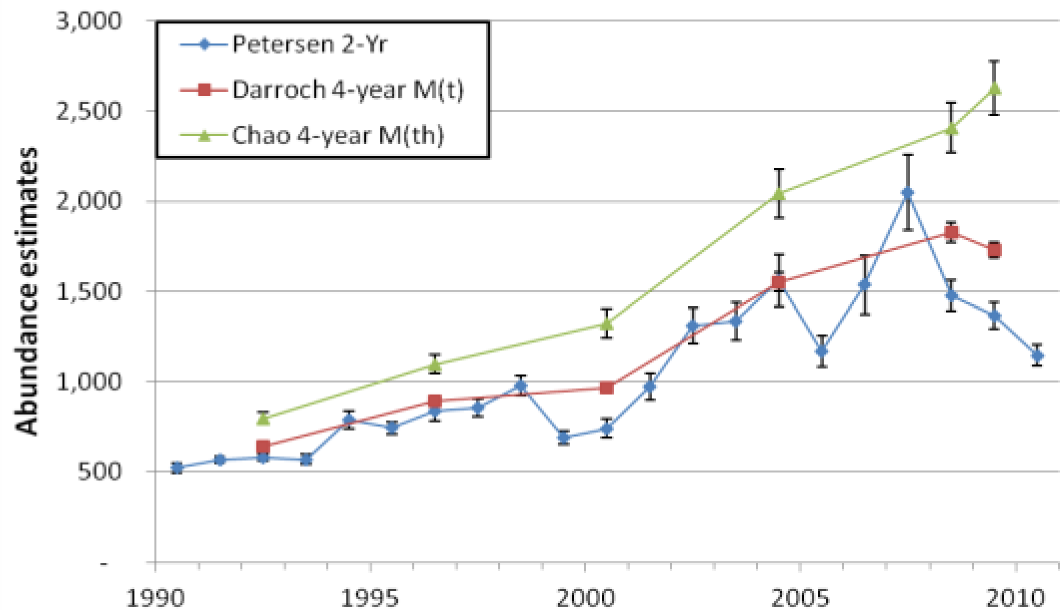
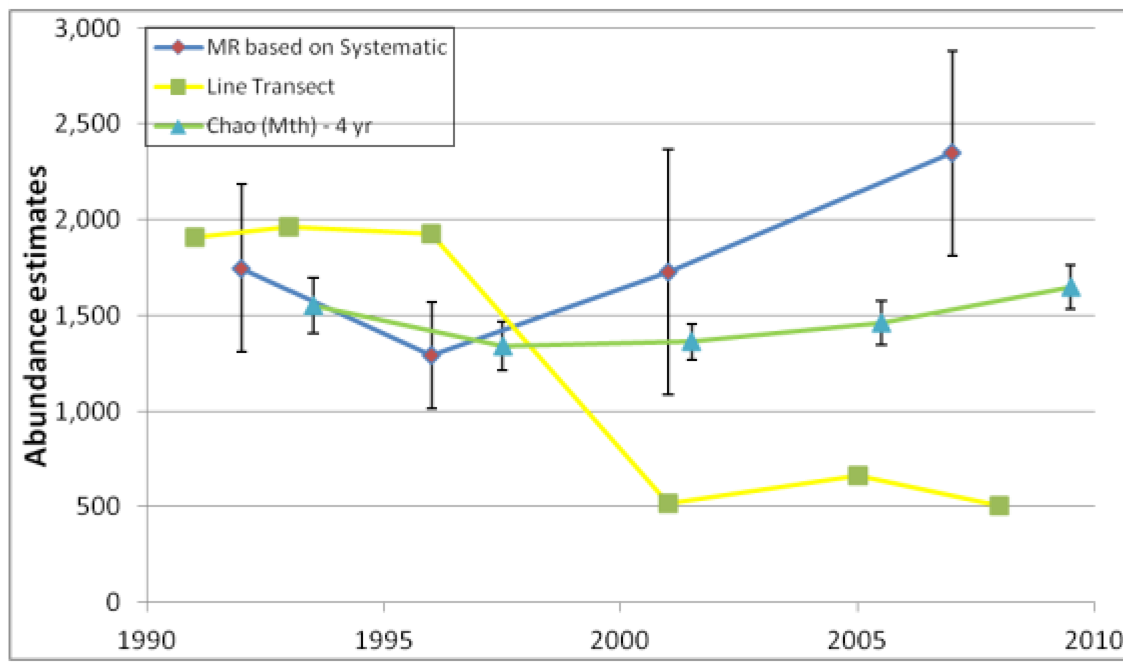


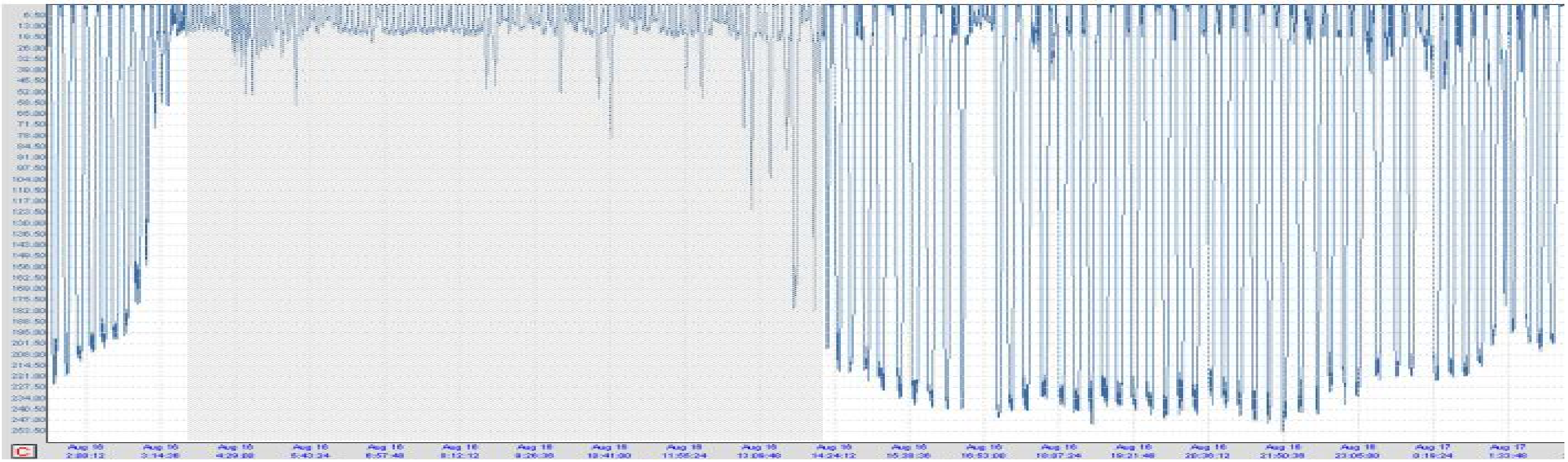
Figure 2. Mean predicted densities and standard errors for (a) humpback, (b) blue, and (c) fin whales (black dots, sightings) in the subset of the study area that overlapped with the shipping routes (black lines).

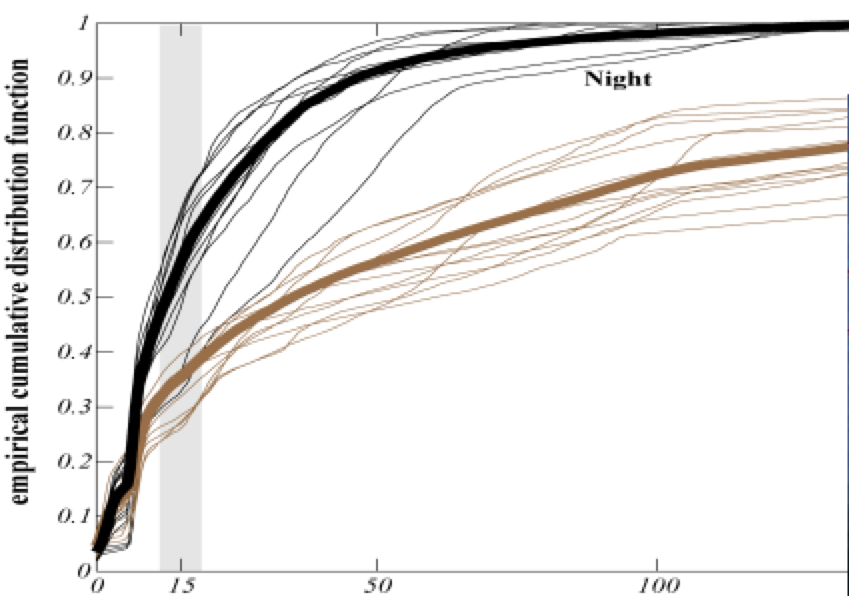
Humpback and blue whale trends - US West Coast





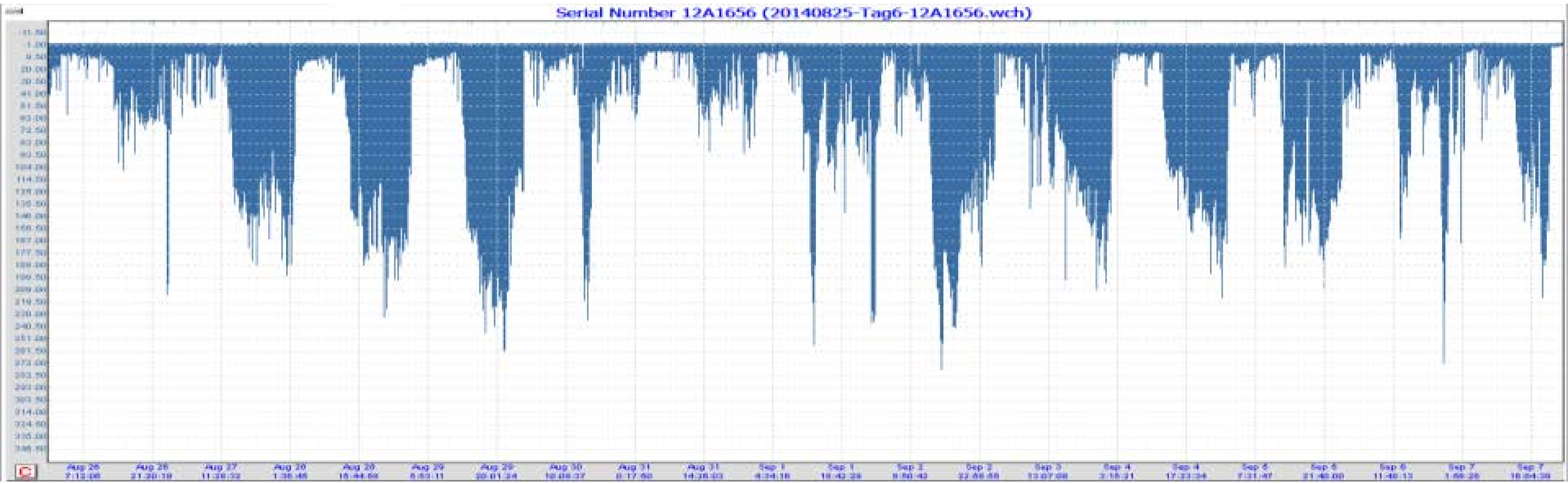
Day–night differences in diving and time near surface

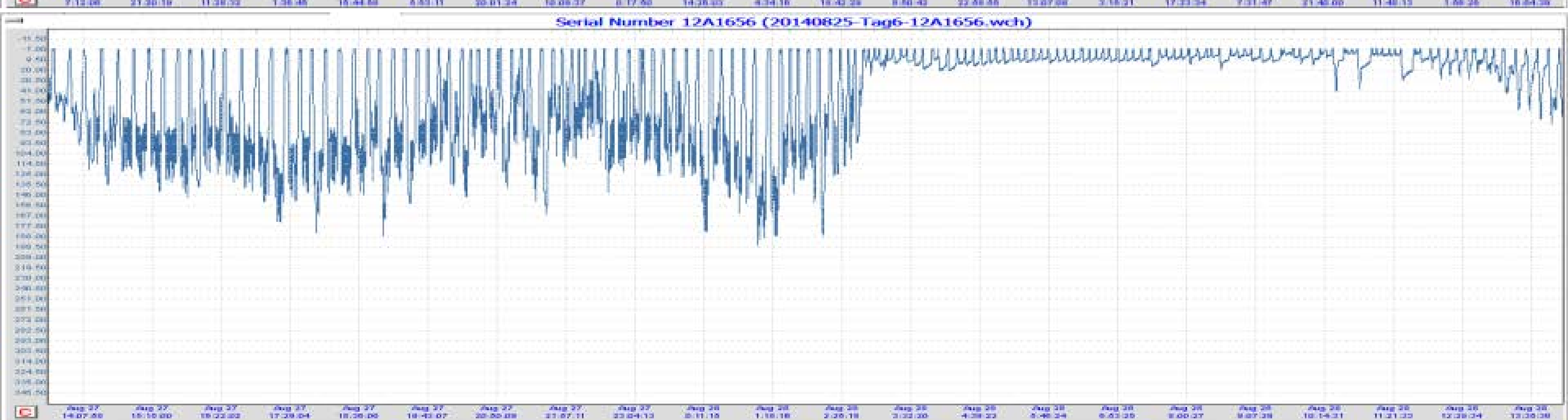




Three deployments of medium duration GPS tags on blue whales in S California in 2014

Dive record from longer term archival tags showing daily cycle





Movement of satellite tagged blue whale
November 2009 through May 2010